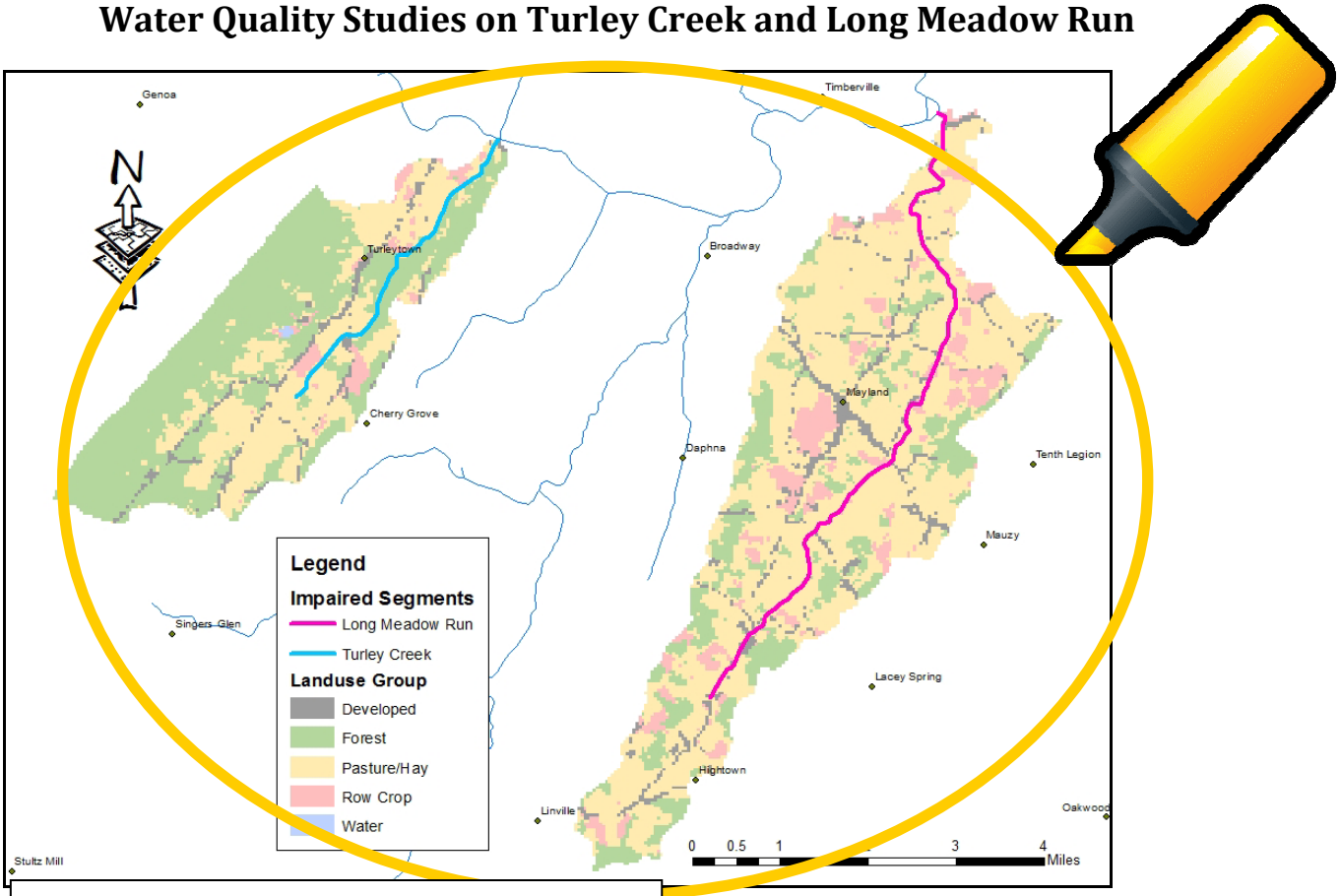
HIGHLIGHTING LOCAL STREAMS:

Water Quality Studies on Turley Creek and Long Meadow Run



Turley Creek and Long Meadow Run Watersheds

The Virginia Department of Environmental Quality (VADEQ) monitors the Commonwealth's streams and rivers (*there are **52,232 miles** of them!*) for five uses: fishing, swimming, wildlife, aquatic life (benthic), and drinking. When streams fail to meet standards based on these uses, they are declared to be "impaired", or not fully supportive of their beneficial uses, and placed on Virginia's impaired waters list. Based on routine water quality monitoring, two streams in Rockingham County have been added to the list of waterways in Virginia that do not meet water quality standards. VADEQ reports this list to the USEPA every other year as required by the federal **Clean Water Act** of 1972. Turley Creek and Long Meadow Run were both listed as "impaired" in 2002 due to violations of the general aquatic life (benthic) standard. A **Total Maximum Daily Load** must be prepared for streams that do not meet water quality standard and are listed as impaired.

Are we being singled out?
No. In Virginia, 68% of assessed streams are considered "impaired".

Total Maximum Daily Load

A TMDL is a pollution budget for a stream, which sets a maximum amount of a pollutant that can be released into a stream but still allows the stream to maintain water quality standards. It is also the process of improvement that Virginia uses to make streams healthier and cleaner. This report is part of the TMDL studies for these streams.

What is the general aquatic life water quality standard? What does benthic mean? The basis of a stream's food chain is found in the community of the aquatic organisms that live at the bottom of the stream, known as benthic (or bottom-dwelling) macroinvertebrates (organisms without backbones that can be seen with the naked eye). These bugs are important because they are a key food source for other organisms, they play an important role in the cycling of nutrients, and they are good indicators of pollutants. The aquatic life water quality standard states that all state waters should support a healthy and diverse community of invertebrates and fish. Based on VADEQ's biological monitoring results, it was concluded that Turley Creek and Long Meadow Run were not meeting this standard. Here are a few examples of benthic macroinvertebrates (all images courtesy of Bob Hendricks).

From Left to Right: Dragonfly larvae, Stonefly nymph, caddisfly larvae, flathead mayfly larvae.

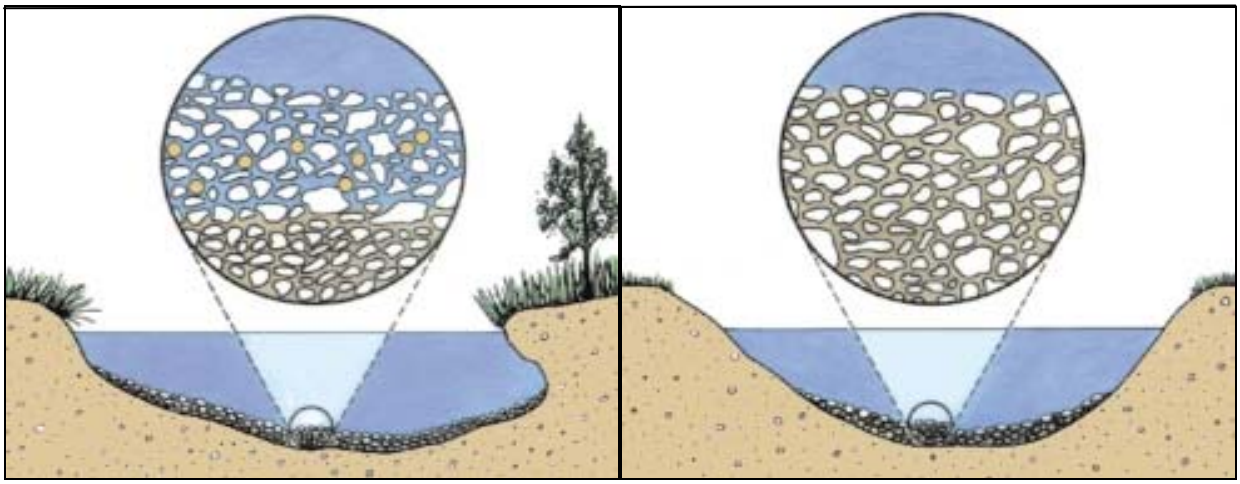
Why don't these streams support a healthy aquatic community? After reviewing various types of data and examining possible stressors in the aquatic habitat, VADEQ, its contractor for this project from Virginia Tech and the Local Steering Committee identified the primary stressor on the aquatic community in each stream to be **sediment**. **Sediment** is soil that has been washed off the land during rain storms and soil that is scoured from the stream banks by fast moving water. In addition, Long Meadow Run has been impacted by **Nitrogen**, a nutrient that assists plant growth – both on the land and in streams.

Where is the sediment coming from? Sources of sediment are typically divided into two categories - **point** and **nonpoint sources**. The sediment in the watersheds for the

two impaired streams involved in this project comes primarily from nonpoint source pollution including agricultural land and stream channel erosion. Development activity (building roads, houses and other buildings) can contribute sediment to waterways if proper controls are not in place. Agricultural lands, such as cropland and pasture/hay areas, often contribute lots of sediment through basic erosion of areas with reduced vegetative coverage. Point sources in these two watersheds are limited, with only two permitted operations in the Turley Creek watershed.

Point Source vs. Non-point Source (Credit: VADEQ – Jeffries and Harrigan)

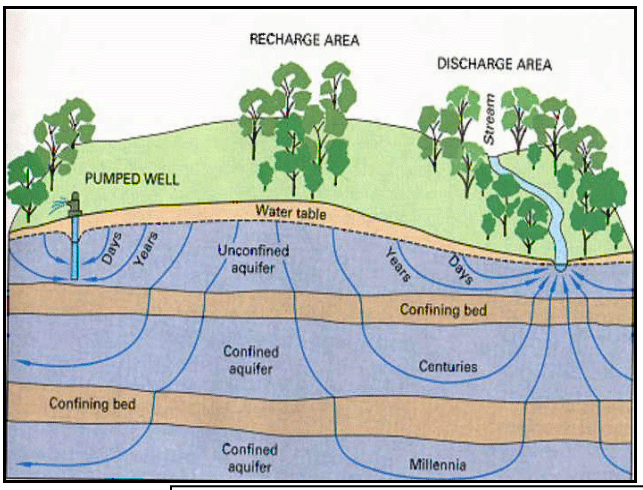
Why is too much sediment in a stream system a problem? Aquatic organisms need space in between rocks and gravels on the stream bottom in order to make their homes, move, and capture prey. With too much sediment, the niches in between the rocks are filled in, it's difficult to travel, and food sources are eliminated. Below is an illustration of a healthy stream bed versus one with extra sediment.



Why is too much nitrogen in a stream system a problem? Nitrogen acts as a nutrient or fertilizer, aiding plant growth wherever it is located. When algae and other water plants grow rapidly, as they do when receiving lots of nutrients, they use up a lot of available dissolved oxygen supply in the water. This leaves very little left for aquatic organisms. Based on VADEQ's chemical monitoring, there is a high level of nitrogen in Long Meadow Run. Also, the biological monitoring has shown an abundance of

organisms that thrive and enjoy a nutrient-rich environment. Further study has revealed high levels of nitrogen in local groundwater samples as well.

Why do we care about nitrogen in the groundwater? In areas of Karst (or limestone) topography, like the Shenandoah Valley, groundwater in aquifers and springs interacts freely and frequently with surface water, like creeks, rivers and ponds. Long Meadow Run is considered a "losing stream" – a stream where much of the flow goes subterranean – until the last 4-5 miles. There are many springs in the area that influence both streams' flow as well. The below diagram illustrates typical groundwater interactions, and the photo of the headwaters of Long Meadow Run highlights the typically dry streambed.

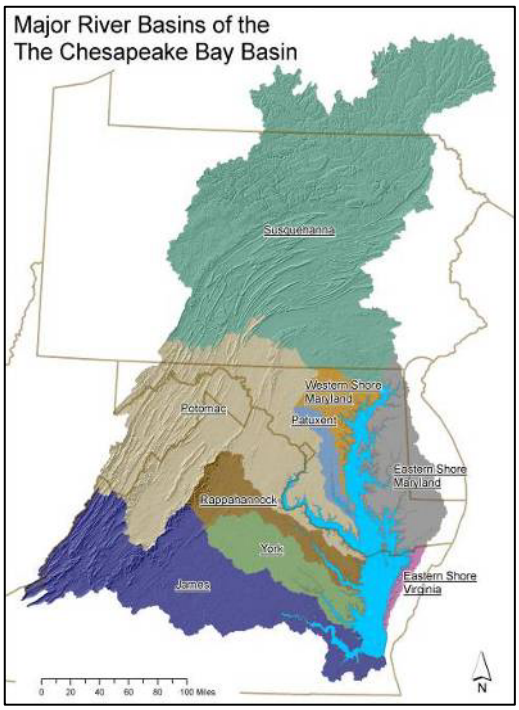


A summary of groundwater interaction and a segment of Long Meadow Run streambed. **(Credit: USGS.gov and VADEQ)**

What is being done? ***(And what, really, is a TMDL?)*** VADEQ and its local and state agency partners have been working together since 2010 to determine sources of the sediment, suggest reductions, and recommend next steps in the process known as the **Total Maximum Daily Load (TMDL)** process. In these **TMDL** studies for Turley Creek and Long Meadow Run, a watershed-based approach was used to relate both land-based and in-stream sources of pollutants to water quality problems. In order to develop a **TMDL**, background pollutant concentrations, point source contributions, and non-point source contributions are considered. Through the **TMDL** process, states are able to identify water-quality based controls to reduce pollution and meet water quality standards.

WHAT IS A WATERSHED? It's an area of land that drains to a common point or body of water.

How do the local stream TMDLs relate to the Chesapeake Bay TMDL? These local TMDLs are based on monitoring of local stream and have been developed to identify the sediment reductions needed in order for these streams to support a healthy and diverse population of aquatic life. The Chesapeake Bay TMDL was developed using monitoring data collected within the Chesapeake Bay watershed which consists of six states and the District of Columbia. It has been developed to identify the nitrogen, phosphorous and sediment reductions needed to restore the water quality in the Chesapeake Bay. The Chesapeake Bay itself is downstream from Rockingham County's local streams and their watersheds. As such, these local watersheds are components of the larger watershed that drains into the Chesapeake Bay, meaning that whatever enters local streams eventually enters the Chesapeake Bay. Conversely, any pollutant reductions to local streams also reduce pollutant loading to the Bay. While these TMDL studies for Turley Creek and Long Meadow Run are focused on how to reduce sediment entering these streams, the measures taken to reduce sediment will also result in reductions of both nitrogen and phosphorus transported to the streams. Therefore, all best management practices and pollutant reductions from these local TMDLs also contribute to the reductions needed to meet Chesapeake Bay cleanup goals.



Whatever we do to clean up our local streams will also help downstream.

So, what reductions are recommended? The table below summarizes the reductions that need to be made from the average amount of **sediment** and **nitrogen** that currently comes into the streams from each watershed, the target amount and the percent reduction that this calls for.

NOTE: One dump truck load = about 20 tons of sediment.
That's 258 dump truck loads moving down Long Meadow Run every year!

	Turley Creek (sediment)	Long Meadow Run (sediment)	Long Meadow Run (Nitrogen)
Avg. Yearly Load	**1,603.5 tons/yr**	**5,157.1 tons/yr**	**525,256 lbs/yr**
Target Yearly Load	**1,069.6 tons/yr**	**3,470.2 tons/yr**	**291,689 lbs/yr**
% Reduction	**34%**	**33.4%**	**45%**

Where do these reductions come from? There are many reasons to decrease the amount of sediment and nitrogen coming into streams and rivers. Not only will the aquatic habitat which is the foundation of a stream's food chain be restored, but water treatment and runoff management costs can be reduced. When more soil is kept on the land, the soil is able to maintain its fertility and productivity. The recommended reductions can be accomplished by installing practices to prevent **sediment** and **nitrogen** from getting into the streams. Techniques that target the land uses that contribute the most sediment will be most effective. With that in mind, the below table summarizes the three land uses that contribute the most sediment in each watershed and the most nitrogen in Long Meadow Run.

Turley Creek Land Uses	Long Meadow Run Land Uses
Pasture	**Pasture**
Cropland	**Hayfields**
Hayfields	**Cropland**

What's next? The goal of the **TMDL** program is to establish a three-step path that will lead to local streams and rivers returning to a healthy state and again meet water quality standards. The first step in the process is to develop **TMDLs** that will result in streams achieving water quality standards, which is a federal requirement under the Clean Water Act. This report represents the culmination of that effort for the aquatic life impairments in Turley Creek and Long Meadow Run. The second step, mandated by Virginia law, is to develop a **TMDL Implementation Plan**. The final step is to put this **"Clean-up Plan"** into place! Implementation of these **TMDLs** will contribute to on-going water quality improvement efforts in these watersheds.

A segment of Long Meadow Run with recent tree planting. (Credit: VADEQ)

There are lots of actions that landowners can do to clean-up Turley Creek and Long Meadow Run, including planting erodible slopes, switching to no-till planting, and providing alternative water supplies while fencing cattle out of streams.

Want more information? Want to make a difference to your local stream? Contact **Shenandoah Valley Soil and Water Conservation District** and the **USDA Natural Resources Conservation Service** for more information on available cost-share programs at 1934 Deyerle Ave, Suite B in Harrisonburg or (540)433-2853 or www.svswcd.org. Find out more about the **Friends of the North Fork of the Shenandoah River** at www.fnfsr.org , call (540)459-8550 or email friends@shentel.net.